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# Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirement Specification (SRS) for the Ocean Color and Chlorophyll


National Aeronautics and
Space Administration

**Goddard Space Flight Center**
**Greenbelt, Maryland**

# Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirement Specification (SRS) for the Ocean Color and Chlorophyll
# JPSS Review/Approval Page

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# Preface

This document is under JPSS Ground Project configuration control. Once this document is approved, JPSS approved changes are handled in accordance with Class I and Class II change control requirements as described in the JPSS Configuration Management Procedures, and changes to this document shall be made by complete revision.

Any questions should be addressed to:

JPSS Configuration Management Office
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# Change History Log

| Revision | Effective Date | Description of Changes (Reference the CCR & CCB/ERB Approve Date) |
|---|---|---|
| Rev- | August 22, 2013 | This version incorporates 474-CCR-13-1159 which was approved by JPSS Ground ERB on the effective date shown. |
| A | Jan 09, 2014 | This version incorporates 474-CCR-13-1401 and 474-CCR-13-1360 which was approved by JPSS Ground ERB on the effective date shown. |
| A1 | Oct 23, 2014 | This version incorporates 474-CCR-14-2091 which was approved by the JPSS Ground ERB for CO10 on the effective date shown. |
| B | Jan 07, 2015 | This version incorporates 474-CCR-14-1721, 474-CCR-14-1741, 474-CCR-14-1781, and 474-CCR-14-2182 which was approved by JPSS Ground ERB on the effective date shown. |

## List of TBx Items

| TBx | Type | ID | Text | Action |
|---|---|---|---|---|
| **None** | | | | |

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# 1 Introduction

The Joint Polar Satellite System (JPSS) is the National Oceanic and Atmospheric Administration's (NOAA) next-generation operational Earth observation program that acquires and distributes global environmental data primarily from multiple polar-orbiting satellites. The program plays a critical role in NOAA's mission to understand and predict changes in weather, climate, oceans and coasts, and the space environment, which support the Nation's economy and protect lives and property. JPSS polar-orbiting satellites provide continued environmental observation that is currently performed by NOAA Polar Operational Environment Satellites (POES). The first JPSS satellite mission, the Suomi National Polar-orbiting Partnership (S-NPP) satellite, was successfully launched in October 2011. It will be followed by two JPSS satellites: JPSS-1, planned for launch in fiscal year (FY) 2017, with JPSS-2 to follow in FY2022.

In addition to the JPSS Program's own satellites operating in the 1330 Local Time of the Ascending Node (LTAN) orbit, NOAA also leverages mission partner assets for better global coverage. These partner assets include the Department of Defense (DoD) operational weather satellites (in the 1730 – 1930 LTAN orbit), European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Meteorological Operational (Metop) satellites (in the 2130 LTAN orbit) and Japanese Aerospace Exploration Agency (JAXA) Global Change Observation Mission-Water (GCOM-W) satellites (in the 1330 LTAN orbit). JPSS routes Metop data from the McMurdo Station, Antarctica to the EUMETSAT facility in Darmstadt, Germany and EUMETSAT provides Metop data to NOAA. For GCOM, JPSS routes the GCOM-W data from Svalbard, Norway through the NOAA Satellite Operations Facility (NSOF) in Suitland, MD to the JAXA facility in Japan. The JPSS program also processes GCOM-W data and delivers GCOM-W products to the JPSS users who have JAXA permissions.

The JPSS Program provides data acquisition and routing support to the Defense Meteorological Satellite Program (DMSP) and the Coriolis Program. The JPSS Program provides data routing support to the National Science Foundation (NSF), as well as the National Aeronautics and Space Administration (NASA) Space Communication and Navigation (SCaN)-supported missions, which include the Earth Observing System (EOS). As part of the agreements for the use of McMurdo Station, JPSS will provide communications/network services for the NSF between McMurdo Station, Antarctica and Centennial, Colorado.

As a multi-mission ground infrastructure, the JPSS Ground System supports the heterogeneous constellation of the before-mentioned polar-orbiting satellites both within and outside the JPSS Program through a comprehensive set of services as listed in Table 1-1.

**Table: 1-1 JPSS Ground System Services**

| Service | Description |
|---|---|
| Enterprise Management and Ground Operations | Provides mission management, mission operations, ground operations, contingency management and system sustainment |
| Flight Operations | Provides launch support and early orbit operations, telemetry and commanding, orbital operations, mission data playback, payload support, flight software upgrade, flight vehicle simulation, and disposal at the end of mission life |
| Data Acquisition | Provides space/ground communications for acquiring mission data |
| Data Routing | Provides routing of telemetry, mission and/or operations data through JPSS' global data network |
| Data Product Generation | Provides the processing of mission data to generate and distribute raw, sensor, environmental, and ancillary data products |
| Data Product Calibration and Validation | Provides calibration and validation of the data products |
| Field Terminal Support | Provides development and operational support to the Field Terminal customers |

## 1.1 Identification

This SRS provides requirements for the Ocean Color Chlorophyll retrieval Environmental Data Record (EDR). The EDR is the concentration of chlorophyll in a vertical column of the surface layer in the ocean. Ocean color, as measured by the radiance reflected by the ocean in a number of narrow visible bands, is used to infer chlorophyll concentration. The main objectives of chlorophyll retrievals are:

- To provide the scientific community with operational data for quantification of the ocean's role in the global carbon cycle and other biogeochemical cycles
- To acquire global data on marine optical properties with emphasis on frontal zones and eddies
- To identify bioluminescence potential in different ocean areas.

With respect to remote sensing, two main types of seawater have been defined. Case 1 waters are characterized by a strong correlation between scattering and absorbing substance concentrations and the chlorophyll a concentration. The open ocean surface water is typical Case 1 water. The strong correlation is due to the fact that all the substances originate in biological processes. A primary source of the substances is photosynthesis of marine phytoplankton. Case 1 waters can be characterized by a single parameter—chlorophyll concentration. Case 2 waters are characterized by a lack of any correlation between scattering and absorbing substance concentrations and chlorophyll *a* concentration. Coastal waters are often referred to as Case 2 waters. Marine phytoplankton is not the dominant, optically active water substance. Particulate matter and colored dissolved organic matter (DOM), which do not always co-vary with chlorophyll, also affect seawater optical properties. Case 2 water can be referred to as multi-parameter water; its optical properties are described by a set of parameters. It must be acknowledged that this classification concept is somewhat idealized because, in reality, all waters belong to an intermediate case.

## 1.2 Algorithm Overview

The Ocean Color/Chlorophyll (OCC) EDR contains chlorophyll a concentration, Ocean Color (Normalized Water-Leaving Radiance, nLw), Inherent Optical Properties of Absorption (IOP-a), and Inherent Optical Properties of Scattering (IOP-s) that are retrieved from remote sensing

reflectance *Rrs*(λ) in the five visible wavelength bands (M1 to M5) of the Visible/Infrared Imaging/Radiometer Suite (VIIRS). The *Rrs*(λ) is defined as the water-leaving radiance divided by the downwelling irradiance just above the sea surface, and are determined from measured top-ofatmosphere (TOA) radiances by the VIIRS Atmospheric Correction over Ocean (ACO) algorithm. We use the Case 2 chlorophyll *a* algorithm developed by Carder *et al*. for use on initial MODIS data. This algorithm is based on a semi-analytical, bio-optics model of *Rrs*(λ). The model has two free parameters—the absorption coefficient due to phytoplankton at 675 nm, *a*ph(675), and the absorption coefficient due to gelbstoff at 400 nm, *ag*(400). The model has many other parameters that are fixed, or are specified based on the region and season of the VIIRS scene.

*Rrs*(λ) values at 412, 445, 488, 555, and 672 wavelengths are retrieved from the VIIRS ACO algorithm and put into the Carder bio-optics model. The model is inverted and *a*ph(675) and *a*g(400) are computed. Chlorophyll *a* concentration is then derived simply from the *a*ph(675) value. The algorithm also outputs the nLw, the IOP-a and IOP-s at the five visible VIIRS wavelengths. The VIIRS sea surface temperature (SST) and seasonal global nitrate depletion temperature (NDT) data (as used in MODIS) are the additional inputs. The algorithm uses the difference in SST and NDT for setting five different sets of model parameters according to the latest branching and weighting strategy employed in MODIS (SeaDAS). When the Carder semianalytic solution is not possible, the empirical OC3V algorithm (the same as the OC3M for MODIS) is used as the default algorithm for chlorophyll retrieval. In addition, an algorithm switch has been installed in the OCC science code for allowing the selection of either the Carder algorithm with the Carder default, or Carder algorithm with the OC3V default, or the OC3V algorithm as the VIIRS chlorophyll a retrieval algorithm. Currently, the OC3V algorithm is selected and is being used for the VIIRS chlorophyll a retrieval algorithm.

## 1.3 Document Overview

| Section | Description |
|---|---|
| Section 1 | Introduction – Provides a brief overview of the JPSS Ground System and the relevant algorithm, as reference material only. |
| Section 2 | Related Documentation – Lists related documents and identifies them as Parent, Applicable, or Information Documents such as, MOAs, MOUs, technical implementation agreements, as well as Data Format specifications. This section also establishes an order of precedence in the event of conflict between two or more documents. |
| Section 3 | Algorithm Requirements – Provides a summary of the science requirements for the products covered by this volume. |
| Appendix A | Requirements Attributes – Provides the mapping of requirements to verification methodology and attributes. |

## 2 Related Documentation

The latest JPSS documents can be obtained from URL: https://jpssmis.gsfc.nasa.gov/frontmenu_dsp.cfm. JPSS Project documents have a document number starting with 470, 472 or 474 indicating the governing Configuration Control Board (CCB) (Program, Flight, or Ground) that has the control authority of the document.

### 2.1 Parent Documents

The following reference document(s) is (are) the Parent Document(s) from which this document has been derived. Any modification to a Parent Document will be reviewed to identify the impact upon this document. In the event of a conflict between a Parent Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

| Doc. No. | Document Title |
|---|---|
| 470-00067 | Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD) |
| 470-00067-02 | Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD), Volume 2 - Science Product Specification |
| 474-00448-01-01 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirements Specification (SRS) for the Common Algorithms |

### 2.2 Applicable Documents

The following document(s) is (are) the Applicable Document(s) from which this document has been derived. Any modification to an Applicable Document will be reviewed to identify the impact upon this document. In the event of conflict between an Applicable Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

| Doc. No. | Document Title |
|---|---|
| 474-00035 | Joint Polar Satellite System (JPSS) VIIRS Ocean Color/Chlorophyll Algorithm Theoretical Basis Document (ATBD) |
| 474-00448-02-24 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume II: Data Dictionary for Ocean Color and Chlorophyll |
| 474-00448-04-24 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume IV: Software Requirements Specification Parameter File (SRSPF) for Ocean Color and Chlorophyll |

### 2.3 Information Documents

The following documents are referenced herein and amplify or clarify the information presented in this document. These documents are not binding on the content of this document.

| Doc. No. | Document Title |
|---|---|
| 474-00333 | Joint Polar Satellite System (JPSS) Ground System (GS) Architecture Description Document (ADD) |
| 474-00054 | Joint Polar Satellite System (JPSS) Ground System (GS) Concept of Operations (ConOps) |

| Doc. No. | Document Title |
|---|---|
| 470-00041 | Joint Polar Satellite System (JPSS) Program Lexicon |
| 474-00448-03-24 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume III: Operational Algorithm Description (OAD) for Ocean Color and Chlorophyll |
| 429-05-02-42 | Joint Polar Satellite System (JPSS) Mission Data Format Control Book for NPP |
| 472-00251 | Joint Polar Satellite System (JPSS) Mission Data Format Control Book for JPSS-1 |

# 3 Algorithm Requirements

## 3.1 States and Modes

### 3.1.1 Normal Mode Performance

SRS.01.24_152 The Ocean Color/Chlorophyll EDR software shall calculate absorption and backscattering with a measurement precision of 20%.

*Rationale:* The measurement precision value was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_244 The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement accuracy of 5%.

*Rationale:* The specified value of 5% is the Science Quality requirement. The 10% level 1 operational requirement is met by the science requirement.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_363 The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement range of 0.1 - 50 W m^-2 um^-1 sr^-1.

*Rationale:* The measurement range value was flowed down from the Level 1 and Level 2 documents. The specified performance range is defined for open ocean. However, for all waters (open ocean, coastal and inland waters), the nLw radiance data range can be 0.1 to 100 W m-2 um-1 sr-1. Measurement ranges applicable to individual, contributing sensor bands may vary from the stated EDR ensemble measurement range requirement as dictated by the expected natural variability of nLw in each band.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_245 The Ocean Color/Chlorophyll EDR software shall calculate absorption and backscattering with a measurement accuracy of 25%.

*Rationale:* The specified value of 25% is the Science Quality requirement. The 35% level 1 operational requirement is met by the science requirement.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_246 The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement accuracy of 25% for concentrations below 10 mg / m^3.

*Rationale:* The specified value of 25% is the Science Quality requirement. The 35% level 1 operational requirement is met by the science requirement.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_247 The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement accuracy of 30% for concentrations above 10 mg / m^3.

*Rationale:* The specified value of 30% is the Science Quality requirement. The 40% level 1 operational requirement is met by the science requirement.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_153 The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement precision of 30% for concentrations below 10 mg / m^3.

*Rationale:* The measurement precision value was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_154 The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement precision of 50% for concentrations above 10 mg / m^3.

*Rationale:* The measurement precision value was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_151 The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement precision of 5%.

*Rationale:* The specified value of 5% is the Science Quality requirement. The 10% level 1 operational requirement is met by the science requirement.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.24_369 The Ocean Color/Chlorophyll EDR software shall produce a chlorophyll measurement for chlorophyll densities between 0.01 and 100 mg m^-3.

*Rationale:* The measurement precision value was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.1.2 Graceful Degradation Mode Performance

SRS.01.24_349 The Ocean Color/Chlorophyll EDR software shall use NCEP extended forecast data when NCEP current data is not available.

*Rationale:* The EDR software through its algorithm must generate products using back up data sources to meet the graceful degradation requirement. The NCEP Total Column Ozone, Sea Surface Wind Speed and Direction, and Surface Pressure forecasts are used by this product. These degraded products are not required to meet the algorithm performance requirements.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.2 Algorithm Functional Requirements

### 3.2.1 Product Production Requirements

Not applicable

### 3.2.2 Algorithm Science Requirements

SRS.01.24_141 The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for ocean color (nLW, normalized water leaving radiances).

*Rationale:* The EDR software through its computing algorithm must produce the normalized water-leaving radiances in accordance with the ATBD for VIIRS Ocean Color/Chlorophyll (474-00035).

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_143 The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the inherent optical properties backscattering.

*Rationale:* The EDR software through its computing algorithm must produce the optical backscattering in accordance with the ATBD for VIIRS Ocean Color/Chlorophyll (474-00035).

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_144 The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the inherent optical properties absorption.

*Rationale:* The EDR software through its computing algorithm must produce the optical absorption in accordance with the ATBD for VIIRS Ocean Color/Chlorophyll (474-00035).

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_145 The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the chlorophyll-a (chlorophyll concentration).

*Rationale:* The EDR software through its computing algorithm must produce the chlorophyll concentration in accordance with the ATBD for VIIRS Ocean Color/Chlorophyll (474-00035).

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_370 The Ocean Color/Chlorophyll EDR software shall generate outputs over open ocean, coastal water and inland water.

*Rationale:* Open ocean, coastal water and inland water are as defined by the land/water mask.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.2.3 Algorithm Exception Handling

SRS.01.24_146 The Ocean Color/Chlorophyll EDR software shall set each <FillField> to <FillValue> according to <FillCondition> specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR><fill>.

*Rationale:* The EDR software through its computing algorithm must fill the ocean color/chlorophyll values based on the established fill conditions to satisfy exclusion and fill conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.3 External Interfaces

### 3.3.1 Inputs

SRS.01.24_149 The Ocean Color/Chlorophyll EDR software shall incorporate inputs as specified in Table 3-1.

*Rationale:* The EDR generation software must be able to receive and process the resource interaction items shown in Table 3-1 in order to produce the intended Ocean Color/Chlorophyll products.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_371 The Ocean Color/Chlorophyll EDR software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Ocean Color/Chlorophyll (474-00448-02-24).

*Rationale:* This defines the formats for Lookup Tables, and Processing Coefficients for input into the algorithm module.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

Table 3-1 and Figure 3-1 are best viewed together since they describe the processes governed by this SRS in different ways. The figure diagrams the data flowing into, out of, and within the code governed by this SRS. The table lists these same data interactions as well as all downstream dependencies for outputs from this SRS.

Each row in the table describes a single software interaction – data flowing from one software item to another. The data is listed in the first column. The second column includes the mnemonic or short name for the data. Blanks indicate there is no mnemonic. The third and fourth columns contain the SRS that generates the data product(s) in the first column, and the SRS that receives those products. The final two columns contain the actual function name in ADL that produces those products, and the function that inputs those products. The SRS's titled "Ingest MSD" and "Store/Retrieve" are non-existent SRS's functioning as data handling for the IDPS. The software functions "Store Products" and "Retrieve Products" are similar non-existent functions that operate as IDPS data handling.

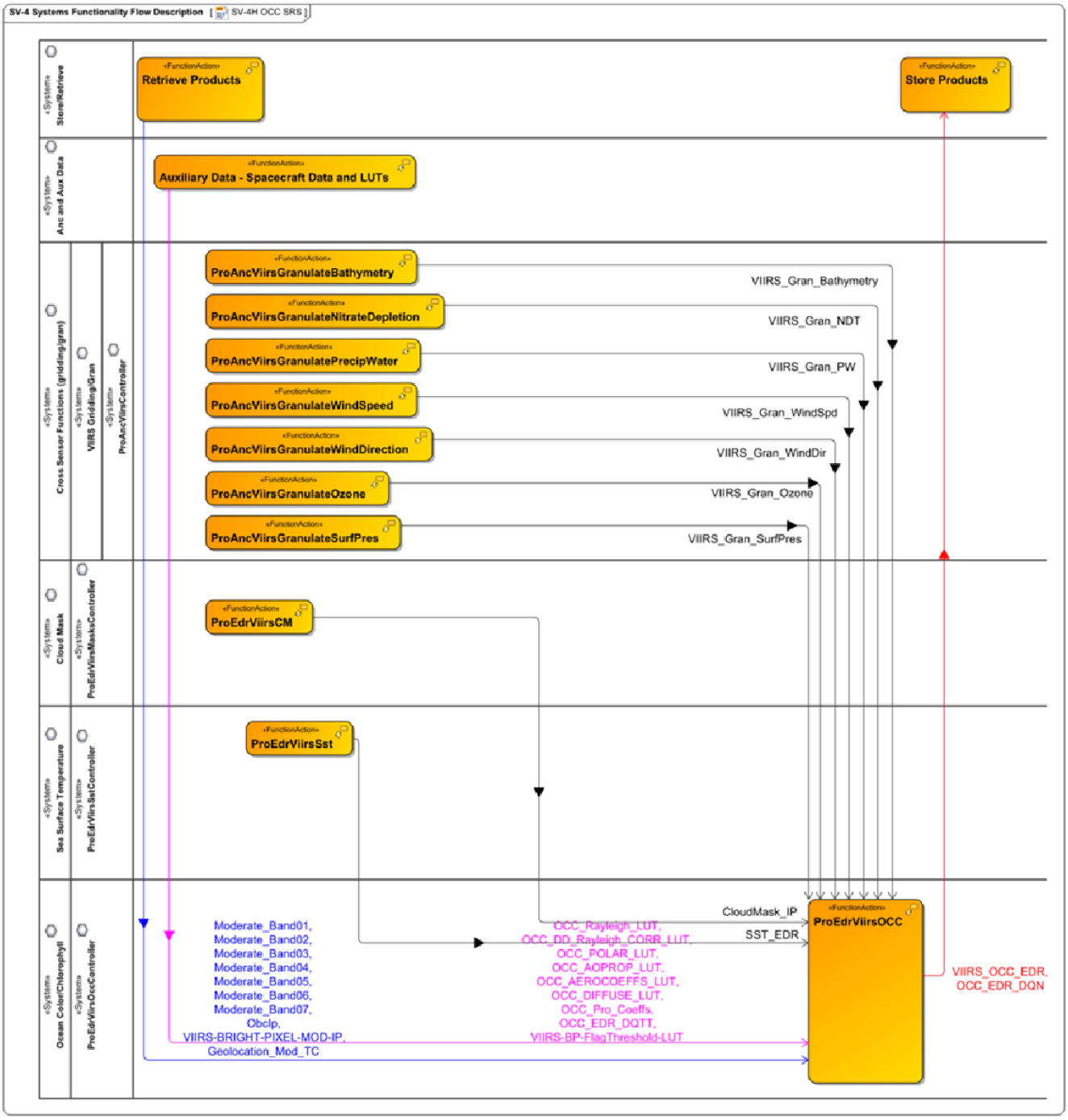


**Figure: 3-1 Ocean Color and Chlorophyll Data Flows**

**Table: 3-1 Systems Resource Flow Matrix: Ocean Color and Chlorophyll**

| Data Product Name | Mnemonic or Short Name, if applicable | Source SRS | Receiving SRS | Sending Function | Receiving Function |
|---|---|---|---|---|---|
| Moderate_Band01<br>Moderate_Band02<br>Moderate_Band03<br>Moderate_Band04<br>Moderate_Band05<br>Moderate_Band06<br>Moderate_Band07<br>ObcIp<br>VIIRS-BRIGHT-PIXEL-MOD-IP<br>Geolocation_Mod_TC | SDRE-VM01-C0030<br>SDRE-VM02-C0030<br>SDRE-VM03-C0030<br>SDRE-VM04-C0030<br>SDRE-VM05-C0030<br>SDRE-VM06-C0030<br>SDRE-VM07-C0030<br>IMPE_VOBC_R0100<br>IMPE_VBPX_R0100<br>VIIRS-MOD-RGEO-TC | Store/Retrieve | Ocean Color Chlorophyll | Retrieve Products | ProEdrViirsOCC |
| OCC_Rayleigh_LUT<br>OCC_DD_Rayleigh_CORR_LUT<br>OCC_POLAR_LUT<br>OCC_AOPROP_LUT<br>OCC_AEROCOEFFS_LUT<br>OCC_DIFFUSE_LUT<br>OCC_Pro_Coeffs<br>OCC_EDR_DQTT<br>VIIRS-BP-FlagThreshold-LUT | NP_NU-LM0040-013<br>NP_NU-LM0234-003<br>NP_NU-LM0234-002<br>NP_NU-LM0040-011<br>NP_NU-LM0040-010<br>NP_NU-LM0040-012<br>DP_NU-LM2030-000<br>NP_NU-LM0235-002 | Anc and Aux Data | Ocean Color Chlorophyll | Auxiliary Data - Spacecraft Data and LUTs | ProEdrViirsOCC |
| VIIRS_OCC_EDR | EDRE-VROC-C0030 | Ocean Color Chlorophyll | Surface Albedo | ProEdrViirsOCC | ProEdrViirsNHF |
| VIIRS_Gran_NDT | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulateNitrateDepletion | ProEdrViirsOCC |
| VIIRS_Gran_Bathymetry | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulateBathymetry | ProEdrViirsOCC |
| VIIRS_Gran_SurfPres | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulateSurfPres | ProEdrViirsOCC |
| VIIRS_Gran_Ozone | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulateOzone | ProEdrViirsOCC |
| VIIRS_Gran_WindSpd | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulate WindSpeed | ProEdrViirsOCC |

| Data Product Name | Mnemonic or Short Name, if applicable | Source SRS | Receiving SRS | Sending Function | Receiving Function |
|---|---|---|---|---|---|
| VIIRS_Gran_WindDir | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulate WindDirection | ProEdrViirsOCC |
| VIIRS_Gran_PW | | Grid Gran | Ocean Color Chlorophyll | ProAncViirsGranulateP recipWater | ProEdrViirsOCC |
| CloudMask_IP | IMPE_CMIP_C0030 | Cloud Mask | Ocean Color Chlorophyll | ProEdrViirsCM | ProEdrViirsOCC |
| SST_EDR | EDRE-SSTE-C1030 | Sea Surface Temperature | Ocean Color Chlorophyll | ProEdrViirsSst | ProEdrViirsOCC |
| VIIRS_OCC_EDR OCC_EDR_DQN | EDRE-VROC-C0030 DP_NU-L00090-001 | Ocean Color Chlorophyll | Store/Retrieve | ProEdrViirsOCC | Store Products |

### 3.3.2 Outputs

SRS.01.24_147 The Ocean Color/Chlorophyll EDR software shall generate the Ocean Color/Chlorophyll EDR product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification Vol II: Data Dictionary for Ocean Color/Chlorophyll (474-00448-02-24).

*Rationale:* The product profile must conform to the XML format file.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.24_148 The Ocean Color/Chlorophyll EDR software shall use the terrain-corrected geolocation for the VIIRS M-band SDR.

*Rationale:* The product must be associated with the terrain-corrected geolocation to meet the geolocation accuracy requirement.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.4 Science Standards

Not applicable.

## 3.5 Metadata Output

Not applicable.

## 3.6 Quality Flag Content Requirements

SRS.01.24_248 The Ocean Color/Chlorophyll EDR software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR><QF>.

*Rationale:* Quality Flags must be generated based on the established flag conditions, logic, and format.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.7 Data Quality Notification Requirements

SRS.01.24_150 The Ocean Color/Chlorophyll EDR software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR> <notification>.

*Rationale:* Notifications must be generated and sent based on the established logic and conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.8 Adaptation

Not applicable.

### 3.9 Provenance Requirements

Not applicable.

### 3.10 Computer Software Requirements

Not applicable.

### 3.11 Software Quality Characteristics

Not applicable.

### 3.12 Design and Implementation Constraints

SRS.01.24_142 The JPSS Common Ground System shall execute the Ocean Color/Chlorophyll EDR algorithm.

*Rationale:* The CGS must incorporate algorithm changes that are supplied by the algorithm vendor.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.13 Personnel Related Requirements

Not applicable.

### 3.14 Training Requirements

Not applicable.

### 3.15 Logistics Related requirements

Not applicable.

### 3.16 Other Requirements

Not applicable.

### 3.17 Packaging Requirements

Not applicable.

### 3.18 Precedence and Criticality

Not applicable.

## Appendix A. Requirements Attributes

The Requirements Attributes Table lists each requirement with CM-controlled attributes including requirement type, mission effectivity, requirement allocation(s), block start and end, method(s) for verifying each requirement, verification events, etc.

| Req ID | Requirement Text | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Verification Event |
|---|---|---|---|---|---|---|---|---|---|---|
| SRS.01.24_152 | The Ocean Color/Chlorophyll EDR software shall calculate absorption and backscattering with a measurement precision of 20%. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_244 | The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement accuracy of 5%. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_363 | The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement range of 0.1 - 50 W m^-2 um^-1 sr^-1. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_245 | The Ocean Color/Chlorophyll EDR software shall calculate absorption and backscattering with a measurement accuracy of 25%. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_246 | The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement accuracy of 25% for concentrations below 10 mg / m^3. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_247 | The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement accuracy of 30% for concentrations above 10 mg / m^3. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |

| Req ID | Requirement Text | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Verification Event |
|---|---|---|---|---|---|---|---|---|---|---|
| SRS.01.24_153 | The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement precision of 30% for concentrations below 10 mg / m^3. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_154 | The Ocean Color/Chlorophyll EDR software shall calculate chlorophyll-a (chlorophyll concentration) with a measurement precision of 50% for concentrations above 10 mg / m^3. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_151 | The Ocean Color/Chlorophyll EDR software shall calculate ocean color (nLw, normalized water leaving radiance) with a measurement precision of 5%. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_369 | The Ocean Color/Chlorophyll EDR software shall produce a chlorophyll measurement for chlorophyll densities between 0.01 and 100 mg m^-3. | P | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | Algorithm Readiness Review |
| SRS.01.24_349 | The Ocean Color/Chlorophyll EDR software shall use NCEP extended forecast data when NCEP current data is not available. | G | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_141 | The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for ocean color (nLW, normalized water leaving radiances). | Ap | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | Maturity Level Declaration |
| SRS.01.24_143 | The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the inherent optical properties | Ap | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | Maturity Level Declaration |

| Req ID | Requirement Text | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Verification Event |
|---|---|---|---|---|---|---|---|---|---|---|
| | backscattering. | | | | | | | | | |
| SRS.01.24_144 | The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the inherent optical properties absorption. | Ap | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | Maturity Level Declaration |
| SRS.01.24_145 | The Ocean Color/Chlorophyll EDR software shall incorporate a computing algorithm provided for the chlorophyll-a (chlorophyll concentration). | Ap | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | Maturity Level Declaration |
| SRS.01.24_370 | The Ocean Color/Chlorophyll EDR software shall generate outputs over open ocean, coastal water and inland water. | Ap | EDR | S-NPP JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_146 | The Ocean Color/Chlorophyll EDR software shall set each <FillField> to <FillValue> according to <FillCondition> specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR><fill>. | E | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_149 | The Ocean Color/Chlorophyll EDR software shall incorporate inputs as specified in Table 3-1. | I | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_371 | The Ocean Color/Chlorophyll EDR software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Ocean Color/Chlorophyll (474-00448-02-24). | Ft | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_147 | The Ocean Color/Chlorophyll EDR | F | EDR | S-NPP | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |

| Req ID | Requirement Text | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Verification Event |
|---|---|---|---|---|---|---|---|---|---|---|
| | software shall generate the Ocean Color/Chlorophyll EDR product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification Vol II: Data Dictionary for Ocean Color/Chlorophyll (474-00448-02-24). | | | JPSS-1<br>JPSS-2 | | | | | | |
| SRS.01.24_148 | The Ocean Color/Chlorophyll EDR software shall use the terrain-corrected geolocation for the VIIRS M-band SDR. | Fg | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_248 | The Ocean Color/Chlorophyll EDR software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR><QF>. | Q | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_150 | The Ocean Color/Chlorophyll EDR software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification Vol IV: SRSPF for Ocean Color/Chlorophyll (474-00448-04-24) <OCC_EDR> <notification>. | N | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |
| SRS.01.24_142 | The JPSS Common Ground System shall execute the Ocean Color/Chlorophyll EDR algorithm. | Ai | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | 2.0.0-ATT |